EXTRADITION OF SANVITALIA TENUIS TO ZINNIA (COMPOSITAE—HELIANTHEAE)

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ABSTRACT

Consideration of morphological similarities and differences suggests that the most recent addition to *Sanvitalia* should be transferred to *Zinnia*. These considerations together with taxonomic synopses of *Sanvitalia* and *Zinnia* sect. *Mendezia*, including keys, revised morphological circumscriptions, and updated geographic distributions, are abstracted.

Sanvitalia tenuis and members of *Zinnia* L. sect. *Mendezia* (DC.) Hoffm. (cf. Torres, 1963) share many characteristics, including the following: 1) resinous/glandular punctae on abaxial surfaces of leaves and ray corolla laminae; 2) receptacular paleae apically scarious, obtuse to acute; 3) ray corollas comprising an orbicular to oblong lamina inserted on a short tube; 4) anther appendages linear-subulate; 5) ray achenes dorsi-ventrally flattened (weakly triquetrous or with an adaxial mid-nerve in some zinnias), epappose to bicornute (some zinnias); and 6) hairs on achenes all straight. In contrast, all other sanvitalias (cf. Torres, 1964) have: 1) no resinous/glandular punctae on leaves or ray corollas; 2) receptacular paleae apically acuminate to a hard, sharp point; 3) ray corollas lacking a tube, laminae inserted directly on achenes; 4) anther appendages deltoid; 5) ray achenes rounded-triquetrous to subterete, pappus of three stout to subulate awns; and 6) hairs on achenes uncinate. In view of these and other similarities and differences, the following transfer to *Zinnia* sect. *Mendezia* seems timely:

Zinnia tenuis (S. Wats.) Strother, comb. nov.—*Sanvitalia tenuis* S. Wats., Proc. Amer. Acad. Arts 23:277. 1888.—TYPE: Mexico, Chihuahua, Sierra Madre, Sep 1887, *C. G. Pringle 1304*. (Holotype: GH!; Isotypes: NY!, UC!,US!)

Having thus altered *Sanvitalia* Lam. and *Zinnia* sect. *Mendezia* as treated by Torres (1963, 1964), it is appropriate to note further differences in circumscriptions. I treat *Sanvitalia angustifolia* as conspecific with *S. procumbens* and agree with McVaugh (1972) in including *Zinnia greggii* in *Z. angustifolia*. I resegregate *Z. palmeri* from *Z. maritima*. The following keys and diagnoses summarize these changes, correct minor errors in descriptions, update distribution records, summarize chromosome numbers, and outline salient similarities

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and differences among the taxa treated. Chromosome numbers included here have all been published; original sources are listed in papers cited here or in standard indices of plant chromosome numbers. Many were originally reported as "*n*" numbers; all are given here as "2*n*" numbers to facilitate comparison.

Key to *Sanvitalia*

Phyllaries 12–20, 2–4-seriate; ray achenes clearly 3-faced, adaxial faces often 2–3-nerved.
  Annuals, perhaps persisting; leaves all entire.
    Disc achenes strongly dimorphic within single heads: the outermost wingless, the innermost clearly 1–2-winged. ..... *S. procumbens*
    Disc achenes essentially monomorphic: 4-angled to laterally compressed but not strongly winged.
      Leaf blades ovate to obovate, length mostly 1–2 times width; ray corollas 1.5–2.5 mm long; awns of ray achenes 2–3 mm long; disc pappus of 0(–2) awns..... *S. ocymoides*
      Leaf blades lance-ovate to lance-linear, length mostly 2–5 times width; ray corollas 2.5–4.5 mm long; awns of ray achenes 1.5–2.5 mm long; disc pappus of (0–)2–4 awns. ..... *S. versicolor*
  Perennial suffrutices; larger leaves irregularly toothed or lobed.... *S. fruticosa*
Phyllaries 8–11, 1–2-seriate; ray achenes subterete, obscurely trigonous, sulcate on each angle and on abaxial face..... *S. abertii*

Diagnoses of sanvitalias

Sanvitalia abertii A. Gray: erect annuals 0.5–2.9 dm high; leaf blades lance-linear, 2–4(–6) cm long, 2–6(–12) mm wide; heads stoutly pedunculate to sessile, solitary; phyllaries 8–11, subequal; ray corollas 2–5 mm long; ray achenes 2.5–3.5 mm long, awns stoutly conical, mostly less than 0.5 mm long; disc achenes essentially monomorphic, 4-angled, laterally compressed, the innermost nearly flat, all tuberculate, epappose; $2n = 22$. Southern California across Arizona and New Mexico into trans-Pecos Texas, south into Baja California Norte, Sonora, Chihuahua, and Coahuila.

Sanvitalia fruticosa Hemsl.: suffruticose perennials to 3 dm high; leaf blades lance-elliptic to lance-linear, the larger ones few-toothed or lobed, 9–26 mm long, (2–)4–12 mm wide; heads nearly to quite sessile, solitary; phyllaries ca. 12–18, graduate; ray corollas 5–7 mm long; ray achenes 3 mm long, awns to 3 mm long; outer disc achenes 4-angled, slightly laterally compressed, tuberculate, epappose, inner disc achenes more flattened, one or both margins narrowly winged, pappus of 1–2 slender awns; chromosome number unknown. Known only from s. Puebla and adjacent Oaxaca.

Sanvitalia ocymoides DC.: sprawling to procumbent annuals, mostly 1–2 dm high; leaf blades ovate to oblanceolate or obovate, cuneately narrowed at base onto petiole, 12–35 mm long, 7–16 mm wide; heads sessile, solitary or in 3's; phyllaries 12–20, subequal; ray corollas 1.5–2.5 mm long; ray achenes 4 mm long, awns 2–3 mm long; disc achenes 4-angled, the innermost slightly laterally compressed but not winged, all strongly tuberculate at maturity, 3.3–3.8 mm long, 0–2 awned; $2n = 32$. Known from s. Texas, Coahuila, Nuevo León, and Tamaulipas (to Jalisco and Querétaro fide Torres 1964).

As indicated in key and diagnoses, differences between *S. ocymoides* and *S. versicolor* are insubstantial. The two population systems may represent bicontinental disjunction within a single species.

Sanvitalia procumbens Lam.: sprawling procumbent to erect annuals to ca. 1 dm high, 3 dm across; leaf blades ovate to lance-linear, 1–2(–6) cm long, 4–13(–31) mm wide; heads sessile, solitary; phyllaries 13–21, graduate; ray corollas (2–)4–9 mm long; ray achenes 2.5–3.5 mm long, awns 1–3 mm long; outer disc achenes weakly 4-angled, laterally compressed, tuberculate, epappose, inner disc achenes laterally flattened, one or both margins winged, pappus of 1–2 slender awns; $2n = 16, 32$. Common, widespread, often ruderal, ranging from Chihuahua and Durango to Tamaulipas, Guerrero, Yucatán, and Costa Rica; adventive in California at Riverside and in trans-Pecos Texas in Chisos Basin (J. Henrickson, pers. comm.).

Ray corollas shorter than awns plus relatively narrow leaves have historically distinguished *S. angustifolia* Engelm. ex A. Gray from *S. procumbens*. But, many plants with longer ray corollas have narrowly lanceolate leaves (e.g., *L. R. Stanford et al. 722, T. F. Stuessy 986, B. L. Turner II 46*). Further, length of ray corolla ranges from 2 to 9 mm and awn length ranges from 1 to 3 mm. Because variation in both foliar and floral characters is considerable, continuous, and extends over a broad geographic area, it seems preferable to recognize a single species.

Sanvitalia versicolor Griseb.: erect to spreading annuals to 2 dm high; leaf blades lance-ovate to lance-linear, 14–32 mm long, 6–11 mm wide; heads sessile, solitary; phyllaries 12–16, subequal; ray corollas 2.5–4.5 mm long; ray achenes ca. 4 mm long, awns 1.5–2.5 mm long; disc achenes 4-angled, the innermost slightly laterally compressed, none winged, all strongly tuberculate, 3.9–4.5 mm long, (0–)2–4-awned; $2n = 32$. Known only from s. Bolivia and n. Argentina.

Key to *Zinnia* sect. *Mendezia*

Receptacular paleae metallic yellow to bright, coppery orange distally, rarely also purple-tinged.

Ray corollas coppery orange to golden yellow (rarely white in *Z. angustifolia*) or pale with an orange spot at base (in *Z. tenella*), laminae mostly 6–15 mm long.

Usually perennials; ray corollas not bicolored; disc corollas ca. 5 mm long. ..... *Z. angustifolia*
Annuals; ray corollas bicolored (look close for spot at base); disc corollas ca. 3 mm long. ..... *Z. tenella*
Ray corollas uniformly pale greenish yellow to white, not orange at base, laminae mostly 4–9 mm long.
Peduncles 2–4 cm long in fruit; ray achenes 3–5 mm long; disc achenes pectinate-winged and ciliolate. ..... *Z. bicolor*
Peduncles 3–6 cm long in fruit; ray achenes ca. 3 mm long; disc achenes scarcely winged, evenly ciliolate. .. *Z. leucoglossa*
Receptacular paleae deep purple to blackish brown distally or stramineous to tip.
Leaves narrowly triangular to linear, length mostly >3 times width, widest near base.
Leaves more than 4 mm wide; heads pedunculate.
Ray corollas 5–11 mm long, uniformly yellow to orange; disc achenes entire-winged ..... *Z. palmeri*
Ray corollas 2–4 mm long, often with purple spot at base; disc achenes pectinate-winged. ..... *Z. purpusii*
Leaves 1–3 mm wide; heads sessile. ..... *Z. tenuis*
Leaves oblong to lance-elliptic, length mostly <3 times width, widest near middle.
Annuals (perhaps persisting but not woody); peduncles 1–5 cm long in fruit; disc corollas orange to yellow distally.....
..... *Z. littoralis*
Perennials, often suffrutescent; peduncles 7–10 cm long in fruit; disc corollas purple distally. ..... *Z. maritima*

Diagnoses of zinnias

Zinnia angustifolia H.B.K.: perennial herbs or suffrutices, sometimes behaviorally annual, 1–3(–5) dm high; leaves petiolate to subsessile, blades narrowly lanceolate to lance-linear, 2–4(–7) cm long, 3–6(–9) mm wide, base truncate to cuneate; peduncles 1–3 cm long in fruit; paleae coppery orange distally, rarely turning black; ray lamina iridescent coppery orange to golden yellow (rarely white), ovate to oblong, 6–12(4–15) mm long; disc corollas distally coppery orange, rarely turning black, ca. 5 mm long; ray achenes 2.8–3.5 mm long, 1.3–1.6 mm wide; $2n = 22, 24$. Common from Sonora and Chihuahua to San Luis Potosí, Nayarit, and Michoacán.

Perennial habit and yellow to white ray corollas have historically distinguished *Z. greggii* Robins. & Greenm. from *Z. angustifolia,* usually characterized as annual with orange ray corollas. McVaugh (1972) noted that all these plants are perennials that may behave as annuals at times and that the different ray colors may be found in single populations. He further said that orange-rayed plants are more

widely distributed and the pale-rayed plants are commonest in the Pacific portions of the coastal states from Sinaloa to Michoacán. He recognized two varieties: var. *angustifolia* and var. *greggii* (Robins. & Greenm.) McVaugh.

Olorode (1970) crossed all six pairings of *Z. angustifolia, Z. greggii, Z. littoralis,* and *Z. leucoglossa,* using plants from a single population of each. Color of ray corollas segregated 21:23 in F_1 of *Z. angustifolia* × *Z. greggii,* suggesting simple genetic control of the color differences and supporting conspecificity. In fact, pollen stainabilities (76–99 percent) and percentage of "plump seeds" (85) in all the F_1's suggest that these four nominal species are perhaps all conspecific. Unfortunately, we do not have results of intraspecific crosses or crosses involving other members of *Z.* sect. *Mendezia.*

Zinnia bicolor (DC.) Hemsl.: annuals (rarely persisting?) to 3 dm high; leaves petiolate to subsessile, narrowly lance-elliptic, 2–4 cm long, 4–9 mm wide, base broadly to narrowly cuneate; peduncles 2–4 cm long in fruit; paleae orange distally, sometimes faintly tinged with purple; ray lamina white to pale yellow, suborbicular to oblong, 5–9 mm long; disc corollas red-orange distally, 3–4 mm long; ray achenes 3–5 mm long, 1.2–2.2 mm wide, disc achenes mostly pectinate-winged and ciliolate; $2n = 22$. Scattered, local populations in San Luis Potosí, Nayarit, Jalisco, and Guanajuato.

Zinnia leucoglossa S. F. Blake: perennial or annual herbs, sometimes weakly suffrutescent, 2–4 dm high; leaves subsessile to short-petiolate, blades narrowly lanceolate, 2–4 cm long, 3–8 mm wide, base truncate to subcordate; ray lamina whitish to pale yellow, suborbicular to ovate, 4–6 mm long; disc corollas coppery orange distally, purple-tinged, sometimes turning black, 4–5 mm long; ray achenes 2–3 mm long, 1.0–1.2 mm wide, disc achenes not pectinate-winged, evenly ciliolate on margins; $2n = 22$. Very local in Sinaloa and Nayarit.

Zinnia littoralis Robins. & Greenm.: sprawling to erect annuals or short-lived perennials, stems to 3 dm long; leaves petiolate, lance-elliptic to oval, length mostly 2–4 times width, 12–35 mm long; peduncles 1–5 cm long in fruit; paleae stramineous throughout or sometimes orange to brown at very tip; ray lamina white to greenish or sulphur yellow, usually drying yellow, orbicular to oblong-elliptic, 5–11 mm long; disc corollas distally golden yellow to orange, 4.1–5.5 mm long; ray achenes 3–4 mm long, 1.4–2.1 mm wide; $2n = 22$. Endemic to environs of Mazatlán, Sinaloa.

In protologue, Robinson and Greenman (1896) cited collections as follows without designating herbaria of deposit: "Collected at Mazatlan by *Th. Coulter,* and rediscovered on dry hills of the coast at the same point by *W. G. Wright,* January, 1889, no. 1201 (distributed as *Z. maritima*?); also by *F. H. Lamb* on dry rocky cliffs at same place, 26 December, 1894, no. 325 (distributed as *Z. maritima*)." Of these,

I have seen *Coulter* at GH; *Wright* at GH, UC, and US; and *Lamb* at GH, NY, and US (2). Torres (1963) cited as type, "T: . . ., *Lamb 325* US! Isotypes: MO! NY!". Neither on the specimens nor in print did Torres indicate that he had seen any of the snytypes at GH. Considering the wording of the protologue and the association of Robinson and Greenman with GH, I reject Torres' lectotypification and instead here designate as lectotype of *Zinnia littoralis* Robins. & Greenm.: *Th. Coulter 335* at GH.

Zinnia maritima H.B.K.: perennials, often suffrutescent (flowering first year?), stems to 3+ dm long; leaves petiolate, oblong to elliptic, length mostly less than 2.5 times width, 6–48 mm long; peduncles 2–10 cm long in fruit; paleae purple distally; ray lamina pale to golden yellow, orbicular to elliptic, 4–9 mm long; disc corollas purple distally, 3.5–4.5 mm long; ray achene body 3–4 mm long, 0.9–1.3 mm wide, apically attenuate and continuous with base of corolla tube; $2n = 26$. Endemic to environs of Acapulco, Guerrero.

Zinnia palmeri A. Gray: annuals (rarely persisting?), 2–4 dm high; leaves short-petiolate to sessile, blades mostly narrowly deltoid to linear-triangular, length mostly 3–7 times width, 2–5 cm long, 4–12(–21) mm wide at the truncate to subcordate-clasping base, margins often obscurely serrate; peduncles 2–15 cm long in fruit; paleae purple distally; ray lamina yellow, suborbicular to oblong, 5–11 mm long; disc corollas purple to blackish distally, 3–4 mm long; ray achene body 1.8–2.8 mm long, 1.1–1.3 mm wide, apically attenuate and continuous with base of corolla tube; $2n = 24$. Locally common in Nayarit, Jalisco, Colima, and Guerrero.

Torres (1963) treated *Z. palmeri* as conspecific with *Z. maritima,* which he characterized as annuals with "variable" leaves. He also said, "*Z. maritima* consists of intergrading races, probably ecotypes . . . ." After consideration of specimens at GH, LL, NY, TEX, UC, and US, including an isotype (*Palmer 386,* US) plus many topotypes (Tequila, Jalisco) of *Z. palmeri* and topotypes (Acapulco, Guerrero) plus photograph of holotype (*Bonpland 3874,* P) of *Z. maritima,* I have concluded that, in spite of considerable morphological variation, two distinct modes are discernable and distinguishable by differences given in the diagnoses.

Zinnia purpusii Brandegee: slender, erect annuals to 3 dm high; leaves sessile or nearly so, blades linear-triangular, mostly 2–5 cm long, (3–)4–7 mm wide at the truncate to subcordate-clasping base; peduncles 1–3 cm long in fruit; paleae purple distally; ray lamina pale yellow, sometimes with spot of purple at base, broadly ovate to orbicular, 2–4 mm long; disc corollas purple to blackish distally, ca. 2.5 mm long; ray achene body broadly elliptic, ca. 2.5 mm long, 1.5 mm wide, apically bicornute and continuous with the stout corolla tube; $2n = 24$. Known from few, isolated populations in Jalisco, Guerrero, and Chiapas.

Zinnia tenella Robins.: erect, rarely spreading annuals to 2 dm high; leaves petiolate, lance-elliptic to lance-linear, mostly 15–35 mm long, 4–8(–14) mm wide; peduncles 1–3 cm long in fruit; paleae coppery orange distally; ray lamina bright to pale yellow with an orange spot at very base, ovate to suborbicular, 6–9 mm long; disc corollas distally golden yellow to red-orange, ca. 3 mm long; ray achenes ca. 4 mm long, 2.2 mm wide, strongly tuberculate; $2n = 22$. Uncommon; Durango, Zacatecas, and Jalisco.

Zinnia tenuis (S. Wats.) Strother: erect annuals to 2 dm high; leaves linear, 6–28 mm long, 1–3 mm wide; heads sessile or nearly so; paleae stramineous to tip or purple-tinged distally; ray lamina pale yellow, ovate to orbicular, 2–3 mm long; disc corollas distally golden yellow, 1.5–2.2 mm long; ray achenes ca. 3 mm long, 1.8 mm wide; $2n = 18$. Known only from Sierra Madre of Chihuahua.

As indicated above, chromosome numbers reported for members of *Zinnia* sect. *Mendezia* are $2n = 18$, 22, 24, and 26. For sanvitalias, $2n = 16$, 22, and 32 are known. So, the chromosome number of *Z. tenuis* (Torres, 1966) is just as novel in *Zinnia* as in *Sanvitalia*.

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